

Sustainability Challenges in the 450mm Technology Node


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Definition of *sustainable* in English:

sustainable

Line breaks: sus|tain|able

Pronunciation: /sə'steməb(ə)l  /

ADJECTIVE

- 1 Able to be maintained at a certain rate or level:

'sustainable economic growth'

MORE EXAMPLE SENTENCES

- 1.1 Conserving an ecological balance by avoiding depletion of natural resources:

'our fundamental commitment to sustainable development'

MORE EXAMPLE SENTENCES

- 2 Able to be upheld or defended:

'sustainable definitions of good educational practice'

MORE EXAMPLE SENTENCES





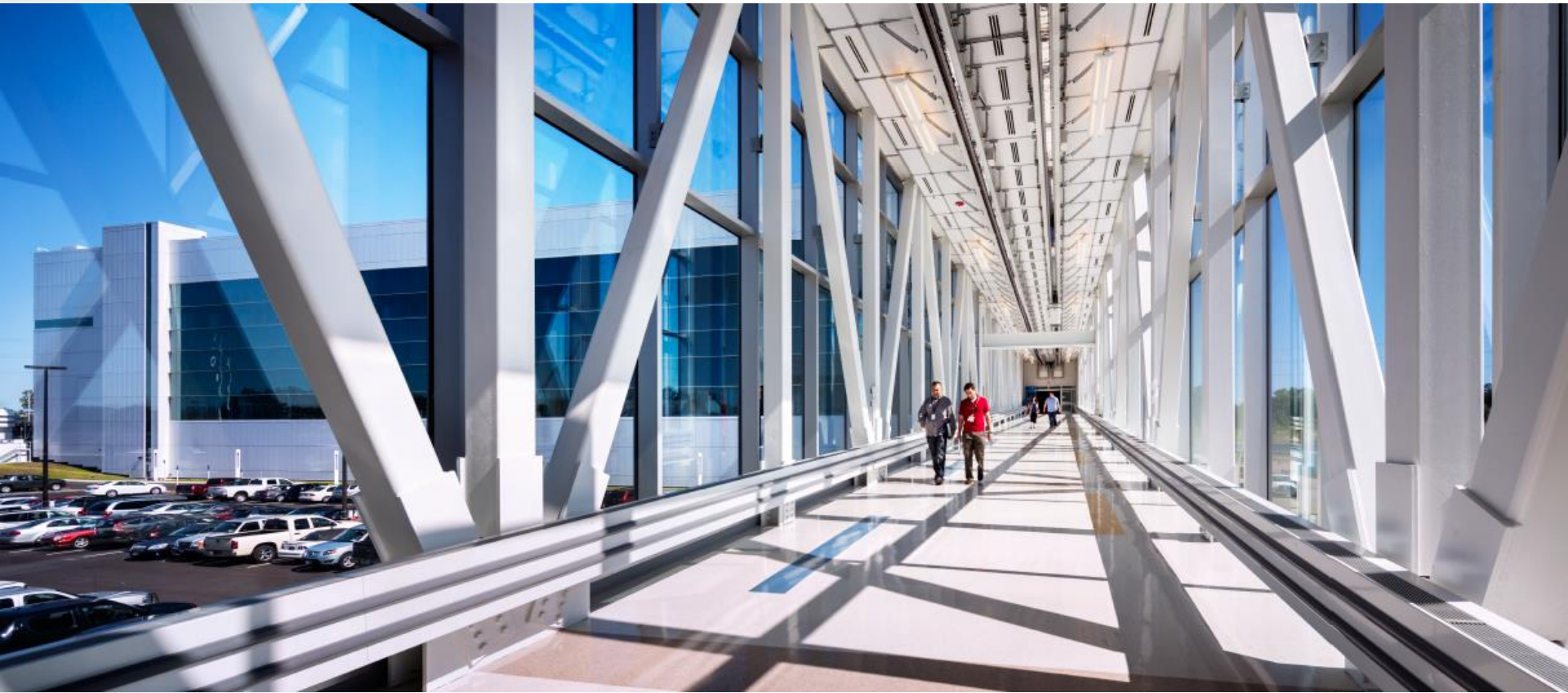
450mm Transition Toward Sustainability

- **G450C** is a public/private program
- Based at the College of Nanoscale Science & Engineering in Albany, New York
- Driving effective industry 450mm development
- Focus on process & equipment development



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A Collaborative Approach

- **F450C** is the Facilities off-shoot of the G450C
- Leading the global effort to design and build the facilities & infrastructure to support the development of 450mm wafer size.
- The G450 & F450 consortia are collaborating to build the framework for this next-generation fab



Bigger Is Not Necessarily Better

The purpose of the 450mm fab is to manufacture more advanced IC's at lower cost with a lighter environmental footprint

Tool-Related Fab Design Guidelines – Change from 300 mm to 450 mm Technology	
Individual Equipment Footprint	+ 20 to 40%
Specific Utility Consumption per m ² of cleanroom (*)	+ 0 to 20%
Cleanroom Height	No increase
Roof Truss Load (**)	May Increase
Waffle Table Floor Load Capability (***)	+ 20 to 30%
Waffle Table Stiffness (***)	May Increase
Vibration Classification	No Change

(*) Increase is mainly driven by new processes and equipment technology, e.g. EUV, single wafer processing etc.

(**) Pending AMHS concept and preference for floor mounted or ceiling suspended maintenance cranes

(***) Mainly driven by simultaneous introduction of new lithography technology, not by wafer size transition

Source: M+W Group, 2013

Scale of Today's 300mm Factory

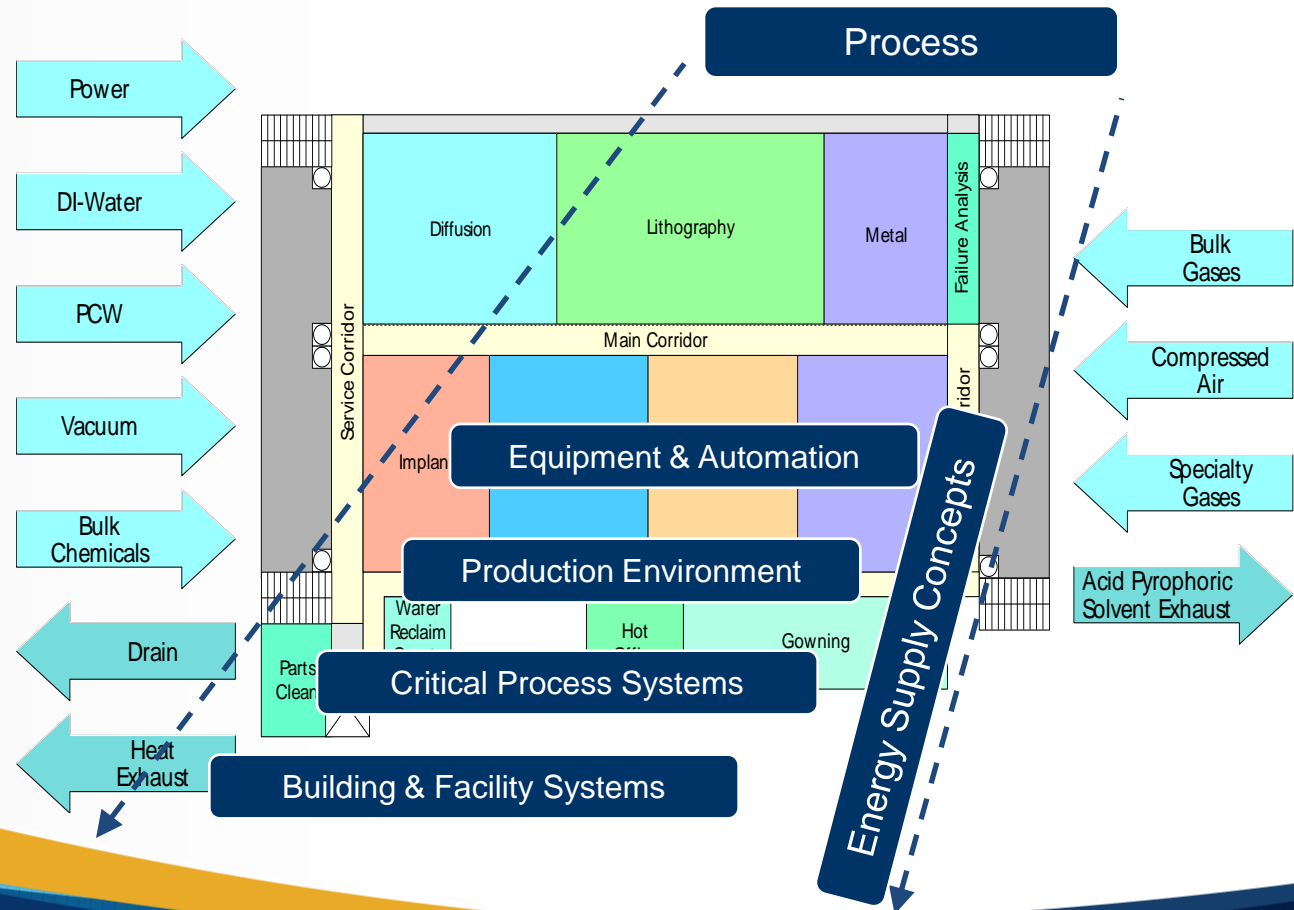
- Managing size and complexity
 - Key to attaining efficiencies for 450mm adoption
- Simply scaling 450mm fab and its facility requirements would exceed affordability



GlobalFoundries Fab8.1 located in Malta, NY

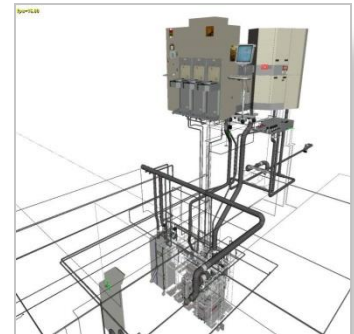
Everything Starts at the Process Level

The function, operation and shape of the facility are driven by process & manufacturing requirements



Utility Use Rates – Effluent Characterization

- Sensors, data collection system installed
 - Power, UPW, IW, Exhaust & Drains (incl. Constituents)
- Data collection methodology developed
- Standard deliverables for each tool characterization
 1. First data collection
 2. Characterization complete
 3. Report published
 - Wet Bench (1) Nov '14; (2) Apr '15; (3) Jul '15
 - CMP Tool
 - Scanner
 - Dry Etch



Component Lift Work Group

- Equipment suppliers are providing 450mm baseline tools
- Some tools are bigger and heavier **than 300mm**
- Need safe way to install and maintain
- Cost of Ownership model established (cost may not be the key factor)
- Safety imperatives
- Productivity suggestions
- Guidelines presented at SEMICON Japan



Greenhouse Gas Emissions Characterization

- Currently measuring post-process & post-abatement exhaust from a 20% F2 process
 - Will determine concentrations and removal efficiency
 - Report emissions to the EPA
- In parallel, determine direct cost (Cost of Ownership) related to controlling toxic air emissions
- PFC, NF₃, and N₂O emissions before Q2'15
- **Protocol-based emissions report for industry distribution (2016)**



Just the Beginning

- Pump Abatement (aka “Green Mode”)
 - Communication Network Installed
 - Baseline Fingerprinting under way
 - A detailed report (white paper) related to Cost of Ownership eval (2016)
- He Conservation and Airborne Molecular Contamination
 - Defining Project Scope
- Tool Installation Methodology – lessons from 300mm



Summary

- CNSE is providing a uniquely neutral and technologically advanced home for critical 450mm infrastructure research
- Work of the F450C is being guided by a strict application of an inside-out design approach
- Key advances have been made in utility requirements, overhead conveyance systems and energy-efficiency strategies
- Lessons learned will be shared and applied to 300mm where applicable
- All key players are coming together – unparalleled collaboration



Thank You

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